Ceredigion Communities Cardiac Rehabilitation Scheme: An Evaluation

Rahman, Rachel Jane; Doust, J. H.

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Ceredigion Communities Cardiac Rehabilitation Scheme: An Evaluation

Final report
March 2007

Prifysgol Cymru
Aberystwyth
The University of Wales
1872

Executive Summary

Introduction

In 2004 a Big Lottery Fund award of £285,535 allowed the development of the Ceredigion Communities Cardiac Rehabilitation Scheme to expand the existing hospital-based Phase III programme and provide a Phase IV element in leisure centres throughout Ceredigion.

The Cardiac Rehabilitation Scheme is a partnership between Ceredigion and Mid-Wales NHS Trust, Ceredigion County Council, Ceredigion Health Alliance, Ceredigion Public Health Team and the University of Wales Aberystwyth. The Scheme is community-based and run at Council-owned leisure centres in Aberystwyth, Aberaeron, Cardigan, and Lampeter.

The Scheme progresses participants into supervised Phase III and Phase IV exercise in order to support recovery from a cardiac event or surgery and to promote a healthy and active lifestyle. The Scheme is deliberately community-based, utilising leisure centres throughout the County in an aim to make the service accessible to all residents of Ceredigion.

Staffing

The Scheme is staffed by a cardiac rehabilitation nurse, a cardiac rehabilitation fitness instructor, an administrator and a researcher. The administrator and researcher are shared with the sister scheme Ceredigion Exercise for Life, a G.P. referral programme.

The Scheme

Following referral, a consultation is arranged with the cardiac rehabilitation nurse. Participants join a group of 8-10 people and attended supervised exercise classes at their chosen leisure centre for 12 weeks. Each participant is given an individualised exercise programme. The classes are based on gym and circuit sessions, with some additions such as badminton, table tennis and walking. The exercise classes are supplemented by a series of health talks and relaxation sessions.

Attendance is free during the period of supervised classes. On completion, participants are offered a six month maintenance package which includes reduced price entry to the leisure centres and the opportunity to contact Scheme staff to discuss progress and receive advice.

Evaluation of Outcomes

- 577 participants were referred in 30 months indicating the level of demand.
- 71% of referrals started classes indicating attractiveness. 69% of participants completed treatment which is high compared to other schemes. Early exit was mainly due to ill-health. This ill-health was associated with the participants' condition, not as a result of the scheme where there were no hospitalisations, resuscitations or deaths.

- The main source of referral was the hospitals. A variable rate of referral from different GP and health centres reflected different extent of engagement.
- The scheme utilised local authority leisure centres throughout the county demonstrating successful partnership work and the local community-base to the programme. Participant evaluation was very strong with around 90%+ reporting high satisfaction with the organisation, the staff, the exercise programme, and their own personal improvement in fitness, health and confidence.
- The structure of the Scheme and the approach of the exercise leaders helped participants improve their feelings of confidence and independence. Social aspects of the approach were also important. These factors were considered important in achieving a high adherence and continuation rate.
- 80% (209 individuals) of the participants who completed the 12 week exercise programme gave consent and participated in the full evaluation
- The exercise programme resulted in a significant improvement in health-related quality of life, anxiety, depression, life satisfaction, physical self-worth, habitual physical activity, waist measurements, skin fold measurements resting heart rate and exercise tolerance. There was no significant change in global self-worth, hip measurements, blood pressure or weight,
- Six-month follow-up after participants left the scheme showed a sustained impact. Of the follow-up sample of 136, 52% (83% of responders) were still exercising and demonstrated a sustained improvement in physical self-worth, physical component of quality of life, habitual physical activity, waist circumference and exercise tolerance. There was no sustained impact on blood pressure, heart rate or mental health
- The scheme cost £802 per participant in total. Allowing for start-up costs, the continuation running costs of the Scheme are £ 722 per new participant. It is common to express the benefit of a treatment in terms of quality adjusted life years added. .The National Institute for Health and Clinical Excellence judges effective treatments as costing less than £20,000 per quality adjusted life year. For the Ceredigion scheme the cost was £8112 per quality adjusted life year

In summary, the scheme:

- Provided Phase IV provision where none existed in Ceredigion
- Demonstrated need by recruiting 577 participants in 2½ years
- Identified the importance of a local community-base and an emphasis on patient confidence and independence in achieving high participation and low attrition
- Demonstrated a sustained impact at 6-month follow-up once participants had left the scheme
- Demonstrated significant improvements in physical and psychological health at a cost per patient of £802 leading to an estimated improvement in quality adjusted life years at a cost of £8112.

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➢ 1. Introduction

1.1 Background to the Scheme

In 2004 a Big Lottery Fund award of £289,572 allowed the development of the Ceredigion Communities Cardiac Rehabilitation Scheme to expand the existing hospital-based Phase III programme and provide a Phase IV element in leisure centres throughout Ceredigion.

The Cardiac Rehabilitation Scheme is a partnership between Ceredigion and Mid-Wales NHS Trust, Ceredigion County Council, Ceredigion Health Alliance, Ceredigion Public Health Team and the University of Wales Aberystwyth. The Scheme is community-based and run at Council-owned leisure centres in Aberystwyth, Aberaeron, Cardigan, and Lampeter.

The Scheme progresses participants into supervised Phase III and Phase IV exercise in order to support recovery from a cardiac event or surgery and to promote a healthy and active lifestyle. The Scheme is deliberately community-based, utilising leisure centres throughout the County.

The Scheme is staffed by a cardiac rehabilitation nurse, a cardiac rehabilitation fitness instructor, an administrator and a researcher. The administrator and researcher are shared with the sister scheme Ceredigion Exercise for Life, a G.P. referral programme.

1.2 Aims of the Scheme

- To provide a cardiac rehabilitation specialist service that is accessible to all residents of Ceredigion with established CHD
- To provide a safe and effective approved cardiac rehabilitation programme to reduce modifiable risk factors in those with established CHD
- To promote the benefits of an active and healthy lifestyle to participants and their families
- To promote social integration and reduce social isolation through the provision of community-based cardiac rehabilitation
- To promote a non-threatening, non-institutional approach to health promotion
- To establish a multi-disciplinary approach to health promotion

1.3 The strategic context

A very large body of scientific evidence has accumulated over the last four decades in support of the proposition that regular exercise has positive benefits to human health in the prevention and management over a number of conditions and diseases including coronary heart disease. Regular physical activity is also conducive to mental well being, weight management, quality of life and the sustainment of independent living. The strength of this evidence is such that internationally many governments have issued policy frameworks to address health problems associated with inactivity.

The Chief Medical Officer's report '*At least five times a week: evidence on the impact of physical activity and its relationship to health*' (Department of Health, 2004) describes the link between physical inactivity and ill health. In Wales the '*Better Health Wales'* strategy set out a framework for reducing inequalities in health and improving health and well being in Wales, themes which were developed in '*Well being in Wales'* (2001), '*Wales a Better Country'* (2003), '*Healthy and active lifestyles in Wales: a framework for action'* (2003) and '*Climbing Higher: Sport and recreation in Wales'* (2005). In particular, the National Service Framework '*Tackling coronary heart disease in Wales: implementing through evidence*' sets out a requirement to establish national and local programmes of physical activity. The appointment by the Government of a "Minister for fitness" in August 2006 demonstrates the political importance of these matters

The National Institute for Health and Clinical Excellence (NICE) is the independent organisation responsible for providing national guidance on promoting good health and preventing and treating ill health. NICE is currently finalising its report on secondary prevention in primary and secondary care for patients following a myocardial infarction (NICE, 2006b). The draft report identifies the evidence for exercise as an intervention along with comments about rehabilitation schemes. The final report is expected to be published in 2007. NICE has also published guidelines on methods to increase physical activity including brief interventions in primary care (NICE, 2006a), and is consulting on *Physical Activity and the Environment*; *Promotion of Physical Activity in Children*; and *Workplace Physical Activity*

Whilst the evidence for the value of exercise per se is strong, there is a less comprehensive body of evidence concerning the most effective approach to cardiac rehabilitation exercise schemes[1], hence the significance of this present evaluation.

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[1] draft NICE (2006) document on secondary prevention:

2.8.4 Uptake and adherence to comprehensive cardiac rehabilitation

Participation of patients after an MI in cardiac rehabilitation has been shown to reduce all cause mortality and cardiac mortality when compared to usual care. The National Service Framework for Coronary Heart Disease states that more than 85% of people discharged from hospital with a primary diagnosis of acute MI or after coronary revascularisation should be offered cardiac rehabilitation. However, less than a third of all patients with a prior MI and those who have undergone coronary revascularisation attend comprehensive cardiac rehabilitation, and uptake is particularly poor among certain groups including ethnic minorities, women, the elderly and those on low incomes or with physical or mental comorbidities. Studies investigating methods to improve uptake and adherence of comprehensive cardiac rehabilitation have been small and limited to individual programmes or geographical locations and have not evaluated interventions specifically for underrepresented patient groups. Consequently, the ability of NICE to provide specific recommendations in this area is limited, as the most clinically and cost effective strategies are unknown.

The evaluation and research arm of the Ceredigion Cardiac Rehabilitation Scheme was designed to provide a detailed and critical evaluation of the Scheme to fulfil the needs of:

- Metrics: the number of type of participants etc.
- Outcome: changes in participants' health and well-being
- Process: the procedures and structures of the Scheme to allow continuous improvement.

1.4 How the Scheme works

The Scheme is managed by a Management Board which meets quarterly and is chaired by a user. The Management Board comprises of user members (one of whom is the Chair), scheme staff, and representatives from Ceredigion and Mid-Wales NHS Trust, Ceredigion County Council, Ceredigion Health Alliance, Ceredigion Local Health Board, Ceredigion Association of Voluntary Organisations, Local Public Health team, University of Wales Aberystwyth, Carmarthenshire NHS Trust.

Day-to-day running is managed by an operational team which meets every two months. Financial matters are handled by a Finance Group which meets quarterly. In addition, the Big Lottery Fund requires an annual monitoring report and regular monitoring meeting with a case officer.

Following referral, a consultation is arranged with a member of the Scheme staff. Participants join a group of 8-10 people and attended supervised exercise classes at their chosen leisure centre for 12 weeks. Each participant is given an individualised exercise programme. The classes are based on gym and circuit sessions, with some additions such as badminton, table tennis and walking. Participants wear heart rate monitors and are given a target range of 60-75% maximum. All classes begin with a warm-up and stretching and end with a cool-down and stretching. In a typical gym session participants will use a range of equipment such as treadmill, cross-trainer, cycle, or resistance machine (with the emphasis on number of repetitions not load). The circuit classes offer a varied routine of stations. The exercise classes are supplemented by a series of health talks and relaxation sessions.

Attendance is free during the period of supervised classes. On completion, participants are offered a six month maintenance package which includes reduced price entry to the leisure centres and the opportunity to contact Scheme staff to discuss progress and receive advice.

➢ 2. Evaluation methods

2.1 Metrics and sampling

Individual patient records provided data on basic demographics, source of referral, attendance and the like. The data reported in the Results (section 3.1) reflects all individuals who were referred.

A sample of participants was used for more in-depth monitoring of the "Outcomes" described below. During the entry consultation participants were given the option of taking part in this research aspect of the scheme and if willing were asked to sign informed consent. Most participants agreed and data were collected on entry and exit (see schedule below).

It was not possible to collect data from those participants who dropped out of the scheme before completing the 12 week programme. The data reported in section 3.2 is therefore derived from a sample of 209 individuals who completed the 12 week programme. This sample reflects 80% of the total number who completed and is therefore likely to be highly representative.

2.2 Organisational and process aspects of the scheme

All participants completed an exit evaluation form. Further information was obtained through monitoring of compliments and complaints, and through formal management meetings.

2.3 Outcomes

Psychological Questionnaires

Questionnaires were administered to participants at various time points in the scheme (see schedule of assessments). All questionnaires are standardised and have been found to be reliable and valid measures. The psychological outcomes measured were as follows:

- Health Related Quality of Life (EuroQol and SF-36V2)
- Anxiety and Depression (HADS)
- Life Satisfaction (Satisfaction with Life Scale)
- Physical self-worth (Physical self-perception profile subscale, PSPP)
- Global self-worth (Adult self-perception profile, ASPP)
- Habitual Physical activity (Baecke)

Physiological Outcomes

On entry and exit to the scheme participants were measured for:

- Hip and waist circumference (cm)
- Weight (Kg)

- Skin fold measurements at four sites (mm); biceps, triceps, subscapular and iliac crest according Durnin & Womersley (1974).
- Resting heart rate (bpm)
- Resting blood pressure (mmHg)
- Post exercise heart rate and blood pressure readings.

The post exercise heart rate and blood pressure readings were taken following a treadmill test carried out to 70% of maximum heart rate or a rating of 14-15 on the Borg rate of perceived exertion scale (see appendix 1). The treadmill test was based upon a modified Bruce protocol (see appendix 2).

Schedule of assessments and questionnaires

The assessments and questionnaires were completed to a carefully worked-out schedule designed to minimise the burden on the participants.

Timing	**Details**	**Method**
Referral received		
With letter inviting to initial assessment	Satisfaction with Life Scale SF-36V2	-Both sent and returned by post and self-completed by participant
With letter inviting to first class and fitness test	HADS PSPP ASPP EuroQol	-All sent by post and returned by post or by hand to first class -All self-completed by participant
Fitness test (first class or within 4 sessions of starting)	Baecke Physical measurements (as outlined above) Treadmill test (as outlined above)	-Completed by participant with the researcher -Carried out by researcher
With letter of invitation to exit assessment at end of phase 4	Satisfaction with Life Scale SF-36V2	-Both sent and returned by post -Both self-completed by participant
At exit assessment	Baecke Physical measurements (as outlined above) Treadmill test (as outlined above)	-Completed by participant with the researcher -Carried out by researcher
With Thank you letter	HADS PSPP ASPP EuroQol	-All sent by post and returned by post -Self-completed by participant

With invitation to participate in 6 month follow-up research	Baecke Activity Questionnaire	-Both sent and returned by post -Both self-completed by participant
With invitation to 6 month follow-up treadmill test	Satisfaction with Life Scale SF-36V2	-Both sent and returned by post -Both self-completed by participant
With thank you letter	HADS PSPP ASPP EuroQol	-All sent by post and returned by post -Self-completed by participant

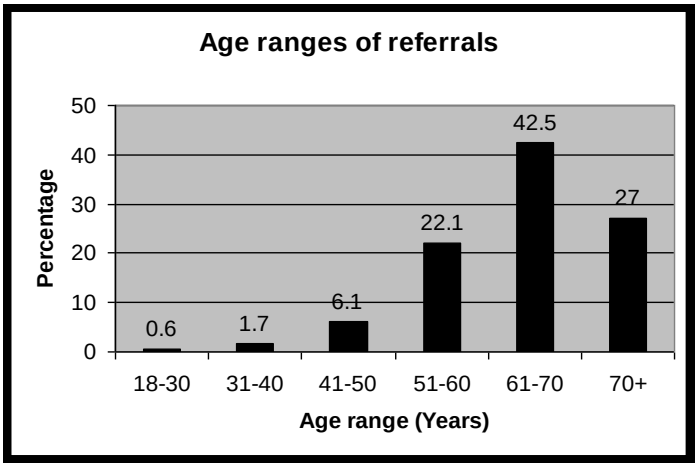
Data were not always normally distributed so non-parametric methods were used to test for significant differences. Pre to post data were statistically analysed using a Wilcoxon signed rank test. Pre, post and 6 month follow-up data were statistically analysed using a Freidman test with Wilcoxon post-hoc tests where required.

3. Results

3.1 Demographics

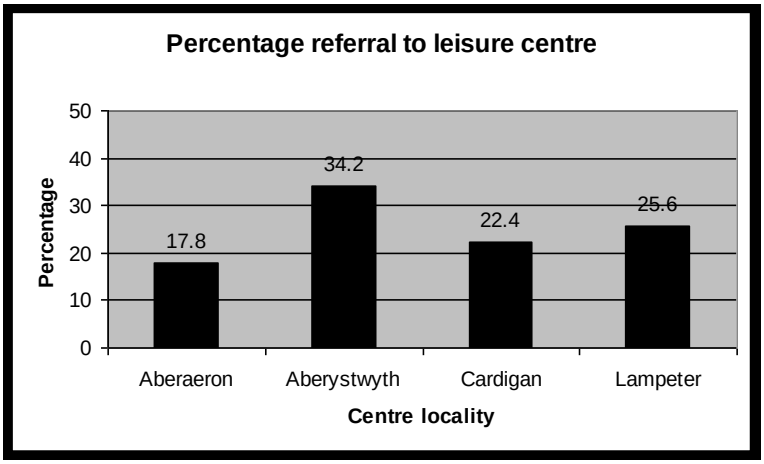
As of December 2006, 577 people have been referred to the scheme. Of these 373 were male and 204 were female. Participants' ages ranged from 18 to 87 years with a mean age of 64.4 years and standard deviation of 10 years. The percentage of people falling into each age category is shown in figure 1. It can be seen that the majority of participants fall between the ages of 61-70 and that referrals are primarily comprised of individuals over the age of 50.

Figure 1.



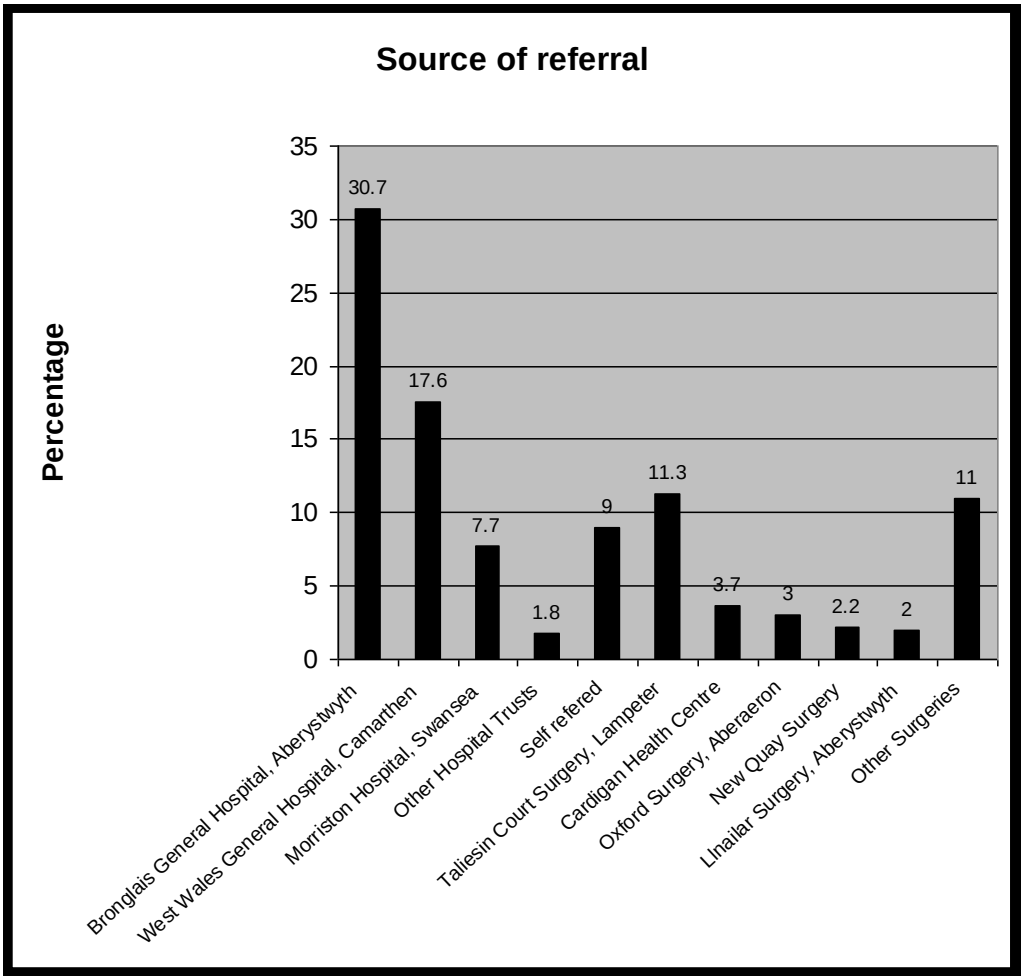
Of those participants referred to the scheme the percentage of referrals to each participating leisure centre is shown in figure 2. It can be seen that Plascrug Leisure Centre, Aberystwyth receives the largest number of referrals, however referrals are otherwise fairly evenly spread throughout the county.

Figure 2.



Referral to the schemes can come from numerous sources. Participants can self-refer or be referred by their GP or practice nurse, cardiac consultant or cardiac rehabilitation nurse. The percentage referrals by source are indicated in figure 3. It can be seen that just over 50% of referrals to the scheme are from hospital trusts with the main referrer being Bronglais General Hospital, Aberystwyth. 9% of referrals are self-referrals with the remainder being from GP surgeries of which Taliesin Court Surgery, Lampeter is the prime referrer.

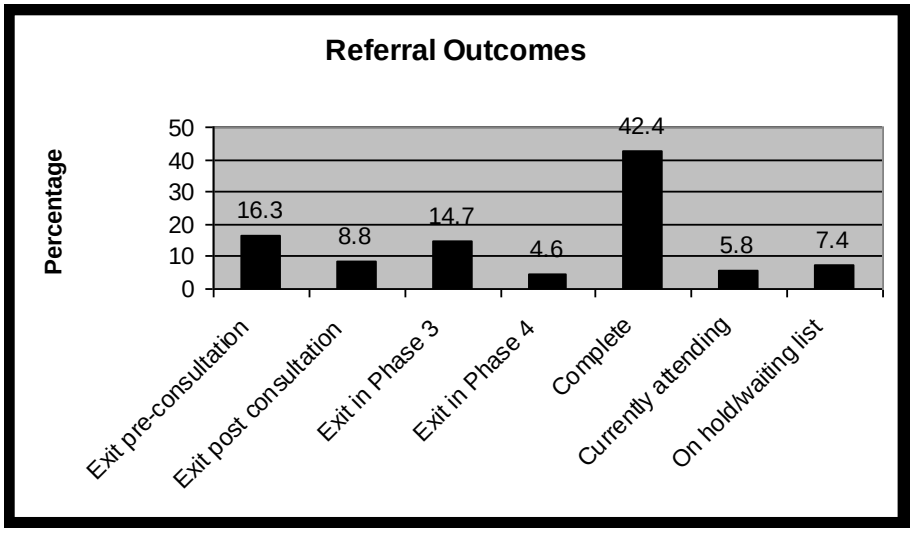
Figure 3.



Retention and Attendance

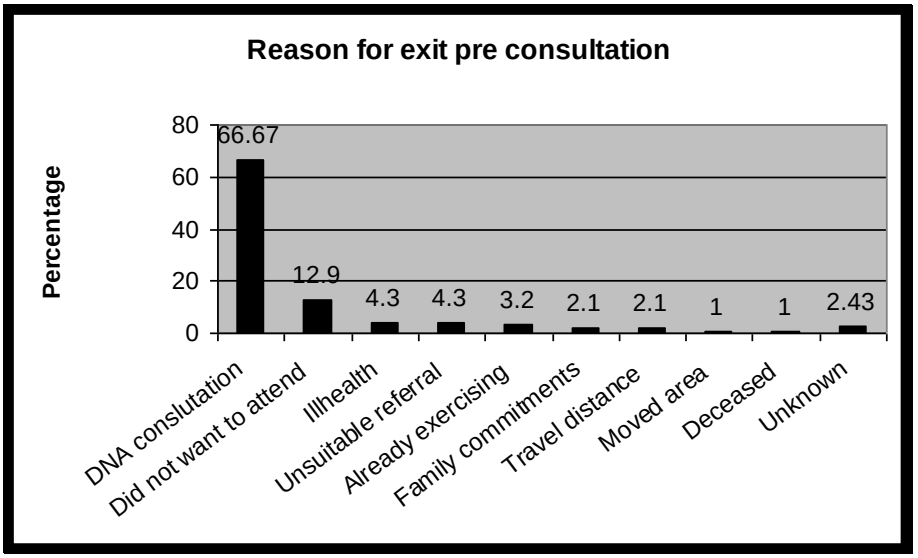
Figure 4 indicates the outcomes of referrals received. 25.1% of referrals received exited the scheme before starting classes. The reasons given by participants for this are indicated in figure 5. However for those participants who do start the classes, the completion rate is 68.9%.

Figure 4.



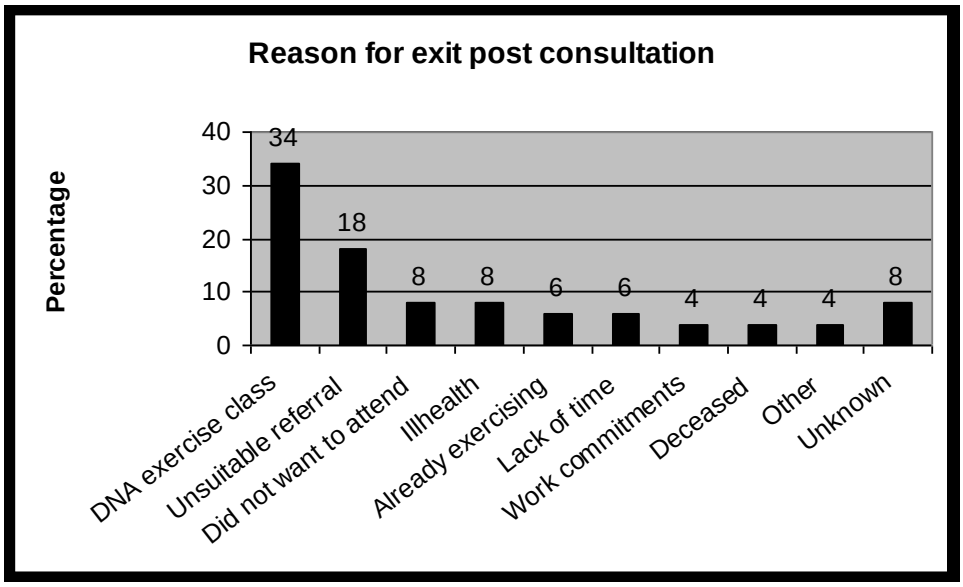
The reasons given by participants for non-retention to the scheme at each time point are shown in figure 5a-d.

Figure 5a



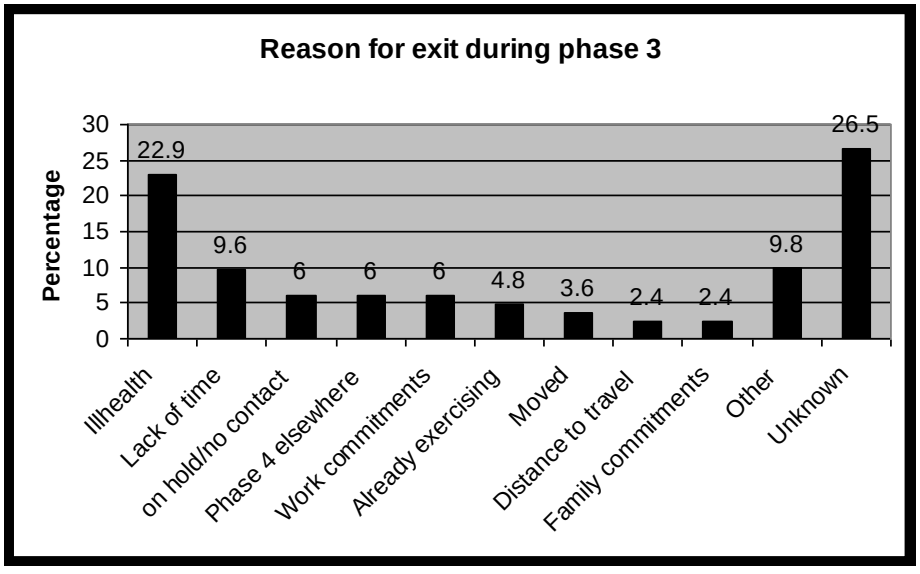
It can be seen that the main reason for individuals exiting the scheme pre consultation is participants not attending their consultation appointment. Following non attendance of an appointment the participant would be sent a letter asking them to contact the office to rearrange the appointment. If no contact with the office was made, the participant was discharged and classed as unretained.

Figure 5b



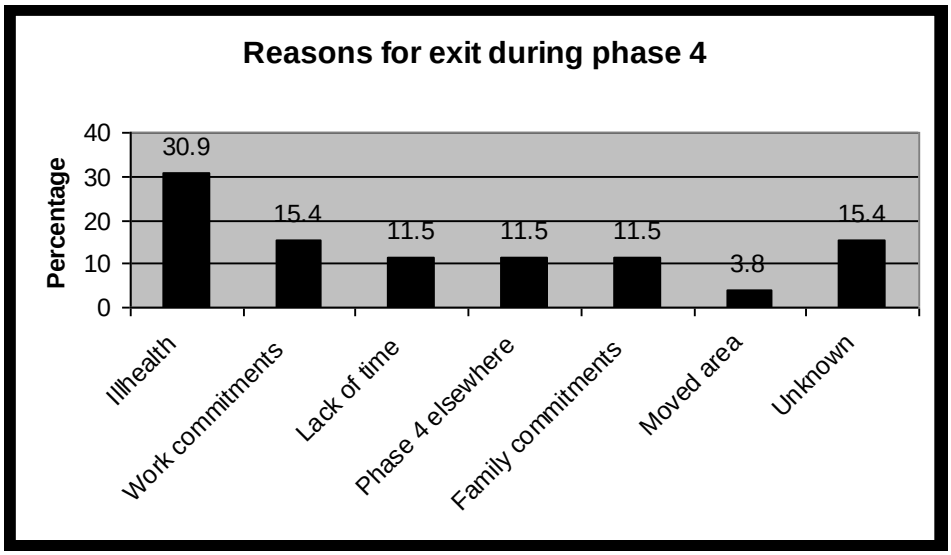
Similarly the main reason for non-retention post consultation was participants not attending the first exercise class and making no contact with the office following a letter to rearrange. This is followed by referrals being classed as not suitable for the scheme during consultation.

Figure 5c



Of those who are not retained during phase 3, 26.5% did not respond to the drop-out questionnaire and therefore their reasons are unknown. The main reason for non-retention given by responders was ill-health followed by lack of time. The 9.8% classed as 'other' includes reasons such as not being motivated to attend and attending phase 3 only as a refresher course.

Figure 5d



Of participants exiting during phase 4, 15.4% did not respond to the questionnaire and therefore their reasons for non-retention are unknown. Ill-health was once again reported as the main reason for non-retention at phase 4. This is followed by work, time and family commitments and attending Phase 4 elsewhere.

The mean attendance of participants, including those who exited part way through the programme, was 57.6% of classes available to them with standard deviation 28.6. Of those who completed the scheme in its entirety the mean attendance rate was 72.4% with standard deviation 17.1.

3.2 Pre to post Scheme change

Pre to post changes were assessed in the sample of participants who agreed to complete the evaluation instruments. This totalled 209 individuals, or 80% of the number of individuals who completed the programme. The table below indicates an overview of the results collected. This is followed by a more detailed breakdown of the results for each measured outcome.

Key:
↑ indicates a significant increase
⇔ indicates no significant difference
↓ indicates a significant decrease

The arrows indicate the direction of change of each parameter. For some parameters an increase is a positive change (e.g. quality of life) while for others a decrease is a positive change (e.g. blood pressure) the desired direction of change for improved health is indicated in the right hand column.

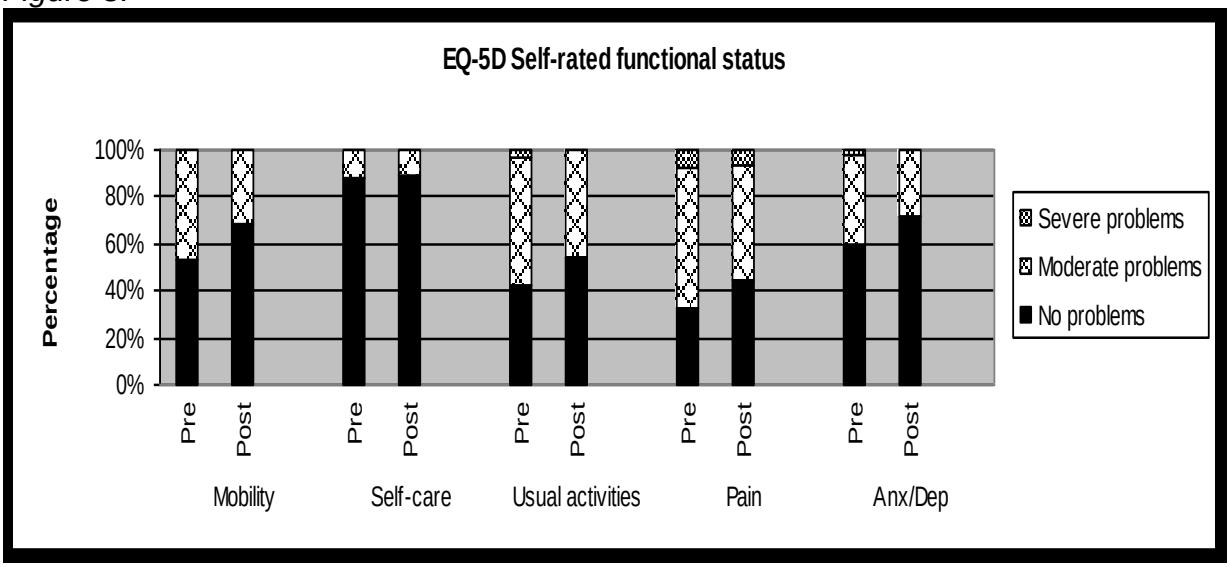
Measure		**Change pre to post scheme**	**Desired direction for change for improved health**
Health related quality of life	EuroQol EQ-5D	↑	↑
	Self-rated health	↑	↑
	SF-36V2 Physical component summary	↑	↑
	SF-36V2 mental component summary	↑	↑
Anxiety		↓	↓
Depression		↓	↓
Life satisfaction		↑	↑
Physical self-worth		↑	↑
Global self-worth		⇔	↑
Habitual physical activity		↑	↑
Hip measurements		↓	↓
Waist measurements		↓	↓
Weight		⇔	↓
Skin fold measurements		↓	↓
Resting heart rate		↓	↓
Resting blood pressure		⇔	↓
Heart rate post exercise		⇔	↓
Blood pressure post exercise		⇔	↓
Treadmill test time		↑	↑

3.2.1 Psychological Outcomes

Health related quality of life (HQol).
Two measures of HQol were used; the EuroQoL and SF-36V2.

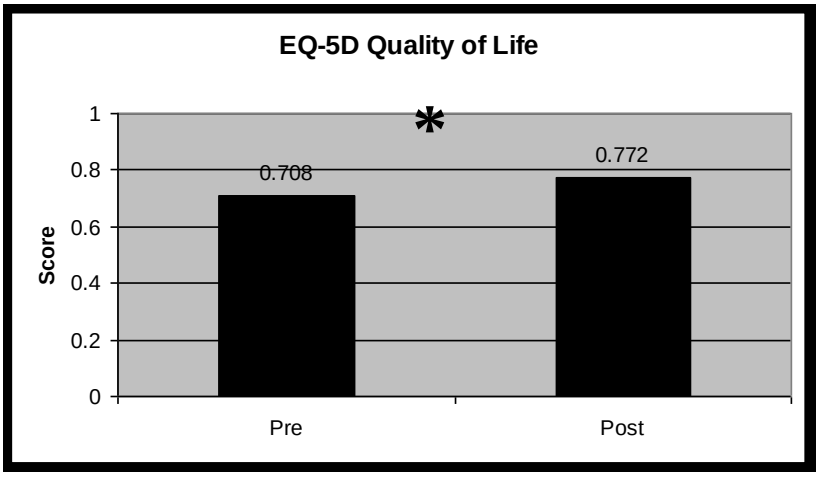
EuroQoL
The EuroQoL EQ-5D measures the health status of individuals based on five domains; mobility, self-care, ability to perform usual activities, pain and anxiety and depression. Participants were asked to rate themselves as having no problems, having moderate or having severe problems in these areas. Figure 8 indicates the percentage of participants classing themselves within each functional status pre and post the 12 week scheme. It can be seen that for most domains the percentage of participants in the severe and moderate sections has decreased pre to post scheme while the percentage classing themselves as having no problems has increased pre to post scheme.

Figure 8.



The scores for each domain were combined to give a health status which was weighted to provide an overall score where 1 represents the best possible score. There was a significant difference found in the overall quality of life score with the score being significantly higher post scheme than pre. Figure 9 illustrates the change in overall score for participants from pre to post scheme.

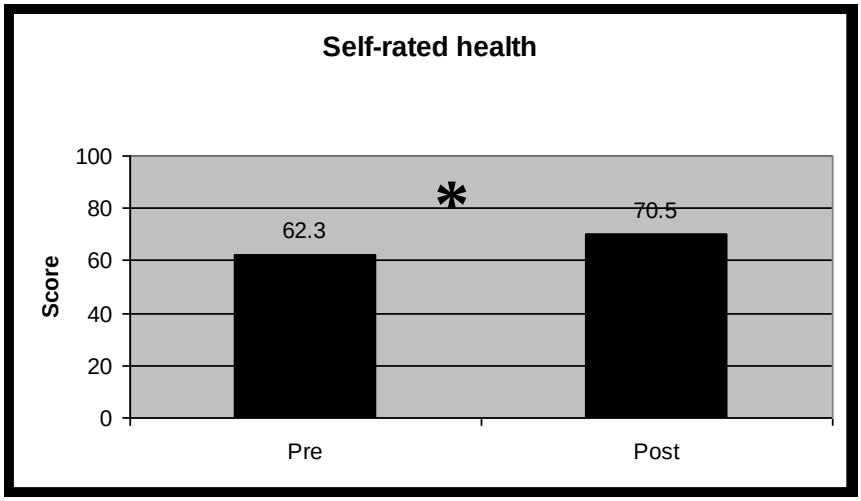
Figure 9



* indicates significant difference

The EuroQol also includes a measure of self-rated health (EQ-VAS). Participants are asked to rate their overall health on a thermometer scale from 0-100 where 100 indicates the best possible health. A significant difference was found in EQ-VAS scores pre to post scheme with participants rating their health significantly better following the scheme. This difference is illustrated in figure 10.

Figure 10



* indicates significant difference

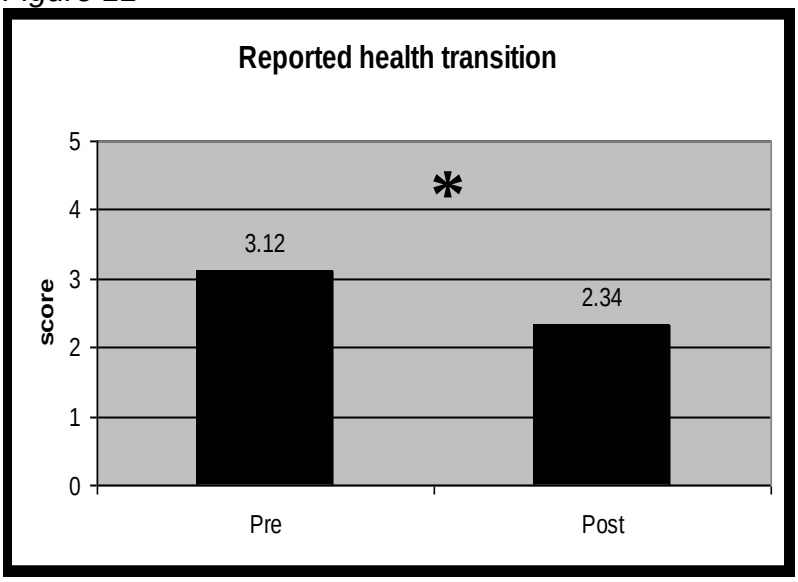
SF-36V2

The SF-36V2 is a 36 item questionnaire providing scores on 8 areas of functioning and well-being. These being physical functioning (10 items), social functioning (2 items), role limitations due to physical problems (4 items), role limitations due to emotional problems (3 items), mental health (5 items), energy/vitality (4 items), pain (2 items) and general health perception (5 items). There is one further unscaled item asking respondents about their 'health change' in the past year (reported health transition). Two standardised

summary scores are then calculated; the physical component summary (PCS) and mental component summary (MCS).

A significant difference was found for the 'health change' question whereby the mean score significantly changed from 3.12 to 2.34 indicating a change in their rated health from 'about the same as one year ago' to 'somewhat better now than one year ago.' (Figure 11).

Figure 11



Much worse now than one year ago

Somewhat worse now than one year ago

About the same as one year ago

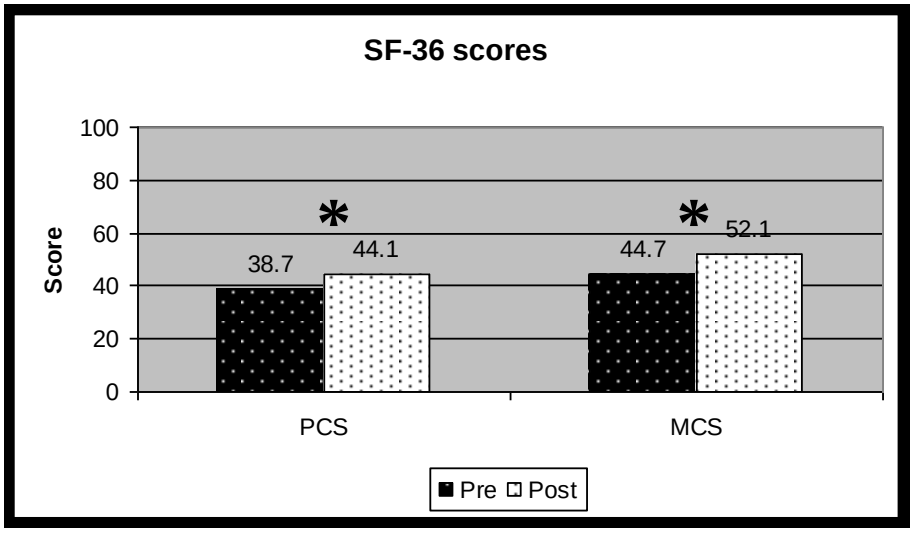
Somewhat better now than one year ago

Much better now than one year

* indicates significant difference

There was also a significant change in the physical and mental component summary scores. Scores significantly increased from pre to post scheme indicating an improved health related quality of life (See figure 12). This increase resulted in scores comparable with U.S. population norms for a similar age group (65-74years, physical 44.34, mental 52.78).

Figure 12

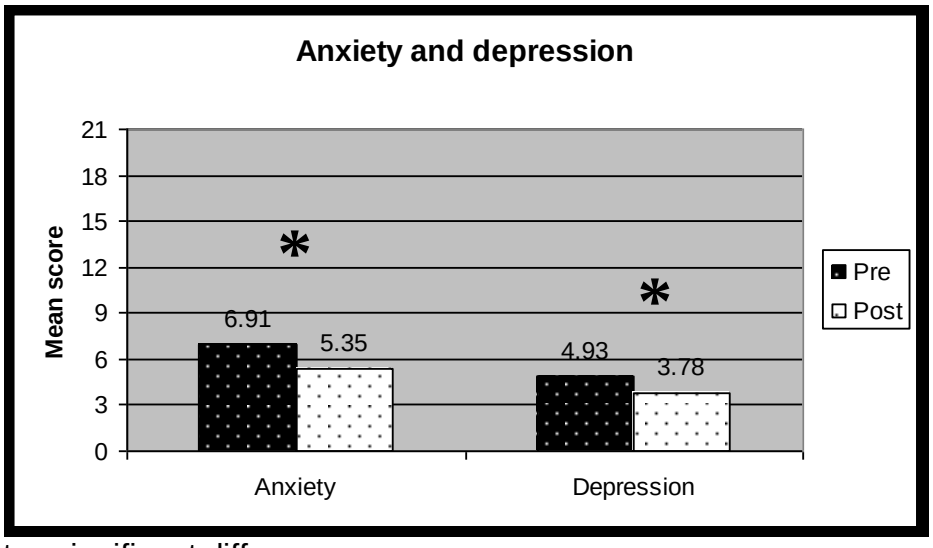


* indicates significant difference

Anxiety and Depression

The Hospital anxiety and depression scale (HADS) was used to measure anxiety and depression levels in participants. The HADS is a 14 item questionnaire which consists of 2 subscales, one measuring anxiety and another measuring depression, which are scored separately. A score of 7 or less for each subscale is indicative of a normal level, scores between 8-10 indicative of mild cases, scores between 11-14 indicative of moderate cases and scores above 15 are indicative of more severe cases. Figure 13 shows the change in anxiety and depression pre to post scheme. Significant decreases in anxiety and depression levels were found from pre to post scheme. It should also be noted that the mean scores for both anxiety and depression, pre and post scheme fall within the range of 'normal.'

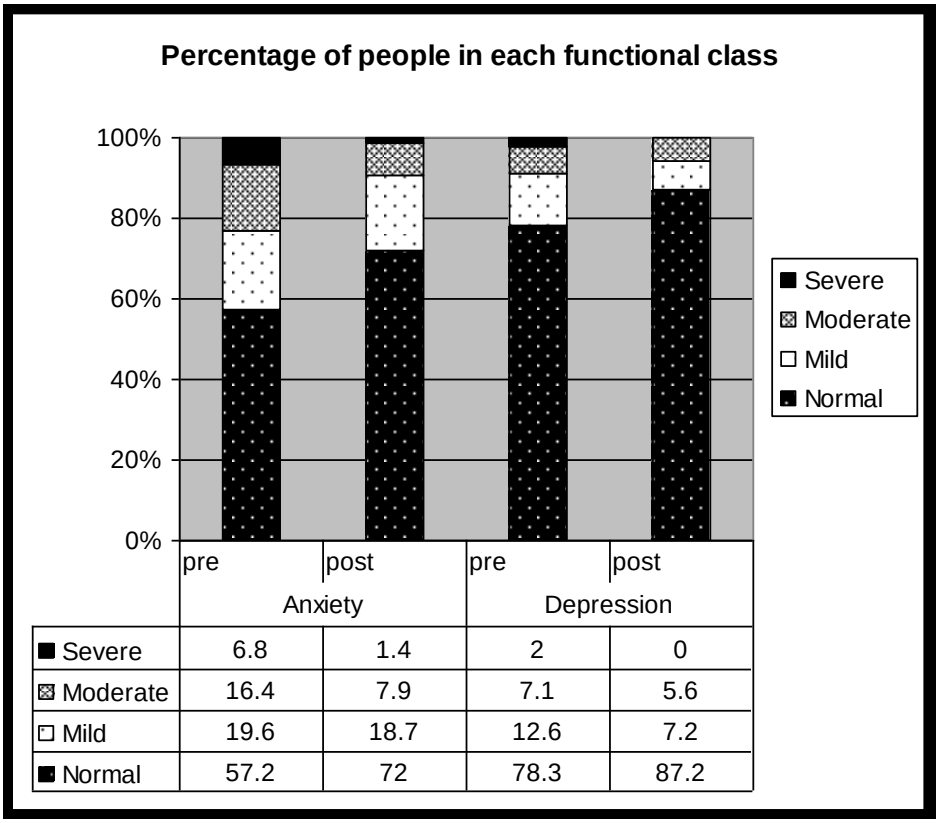
Figure 13



* indicates significant difference

Figure 14 indicates the percentage of people that were classed as having normal, mild, moderate or severe anxiety and depression pre to post scheme. It can be sent that the percentage being classed as having severe anxiety or depression reduces to having only one person (anxiety) or no-one within this bracket (depression). Furthermore the percentage of people being classed as having anxiety or depression within the normal range increases substantially from pre to post scheme.

Figure 14

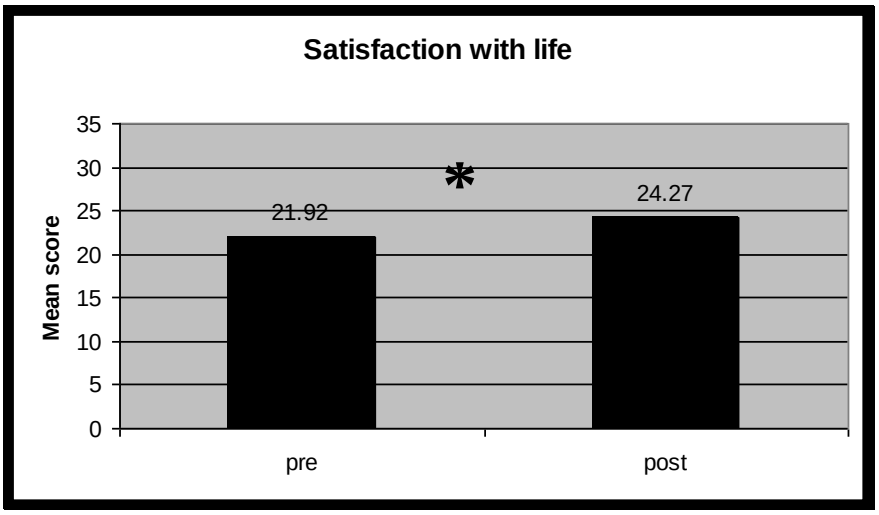


	pre	post	pre	post
	Anxiety		Depression	
Severe	6.8	1.4	2	0
Moderate	16.4	7.9	7.1	5.6
Mild	19.6	18.7	12.6	7.2
Normal	57.2	72	78.3	87.2

Life Satisfaction

The satisfaction with life scale uses 5 items to measure respondents' overall assessment of their lives. Items are scored on a 7 point likert scale where the lowest score of 5 indicates dissatisfaction with life while the top score of 35 indicates full satisfaction with life. A significant increase in life satisfaction score was found from pre to post scheme as shown in figure 15.

Figure 15.

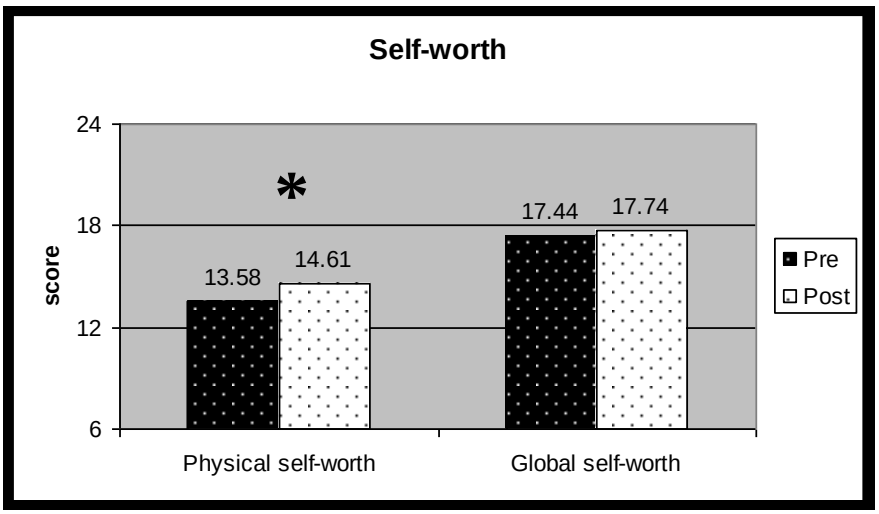


* indicates significant difference

Physical self-worth and global self-worth

This subscale assesses perceptions of an individual's general feelings of happiness, satisfaction, pride, respect and confidence in the physical self and themselves in general. A significant improvement was found for physical self-worth however no significant difference was found for global self-worth from pre to post scheme (Figure 16).

Figure 16.

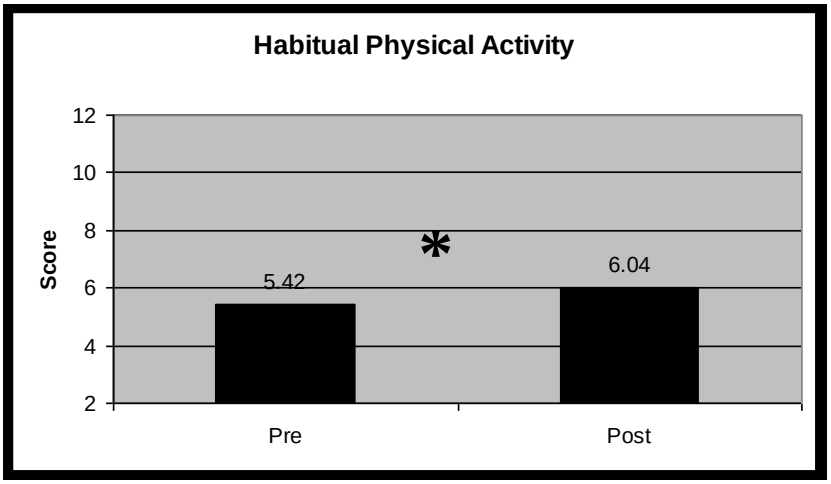


* indicates significant difference

Habitual physical activity

The Baecke questionnaire comprises of 16 items which make up three subscales, namely work, sport and leisure. These are combined to give an overall habitual activity score ranging between 2 and 15 where a higher score indicates higher levels of activity. It should be noted that a large sample of the participants did not work and therefore the maximum score achievable was 10. This may account for the low mean scores. A significant increase was found for habitual physical activity from pre to post scheme (figure 17)

Figure 17



* indicates significant difference

3.2.2 Physiological Outcomes

No significant difference was found for weight. Hip measurements significantly reduced by approximately 1cm (pre 106.95cm; post 105.77cm) while waist measurements significantly reduced by approximately 2cm (pre 98.56cm; post 96.88cm).The sum of skin fold measurements also significantly reduced from 83.6mm to 79.2mm.

No significant difference was found for resting blood pressure however resting heart rate significantly reduced from 67bpm to 64bpm pre to post scheme. There was no significant difference in blood pressure or heart rate following the fitness test. However fitness levels significantly improved pre to post scheme as indicated by a significantly longer treadmill test. The duration of tests increased from 6.81min to 8.95min before participants reached their target heart rate.

Figure 18 indicates the percentage of participants that stopped at the end of each modified Bruce stage pre and post scheme. It can be seen that after the 12 weeks of the exercise scheme, substantially fewer people were stopping the treadmill test in the first six minutes (<stage 0 and stage 0) Substantially more people were managing to complete stages 1 (6 min) and 2 (9 min) of the protocol.

Figure 18

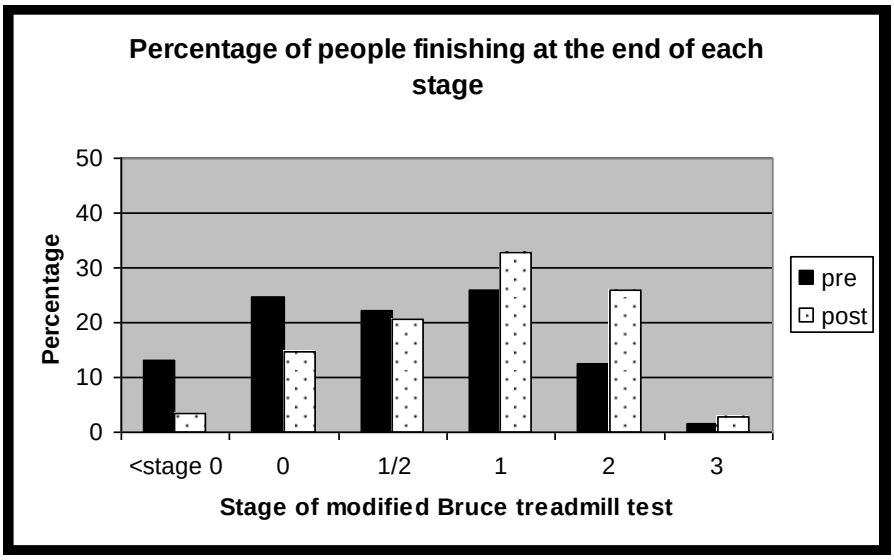
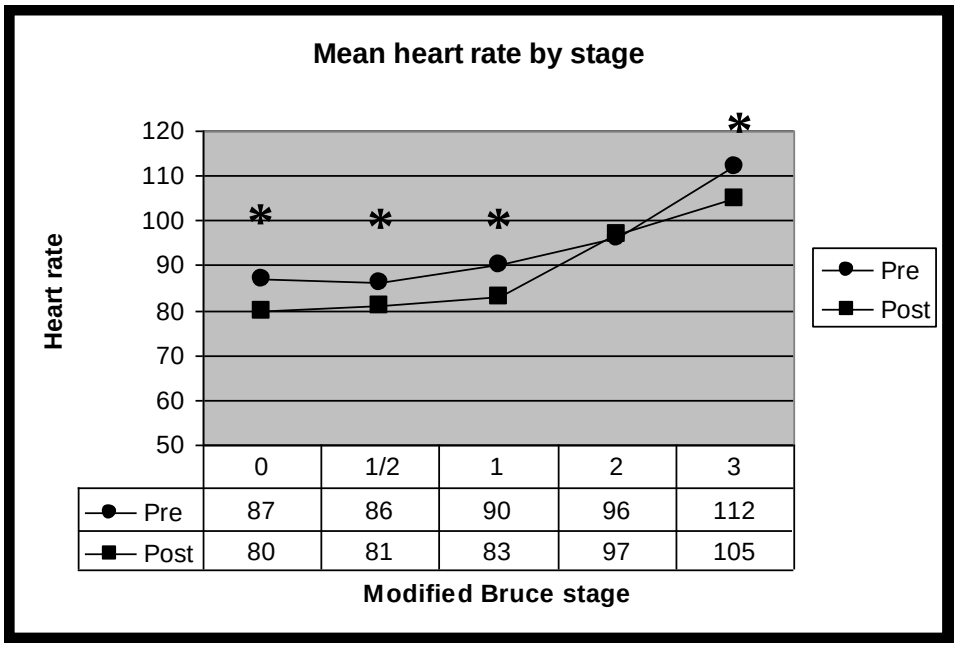


Figure 19 shows the mean heart rate of participants at the end of each modified Bruce three minute stage. The average heart rate at each stage of the test is lower post scheme than pre indicating improved fitness except for stage 2. This reduction was significant during stages 0, ½, 1 and 3.

Figure 19.



3.3 Sustainability

3.3.1 Sustainability of activity

Follow-up letters were sent out to all participants completing the scheme to establish the longer-term impact i.e. six months after leaving the Scheme. The follow-up was undertaken only in those participants who had completed the scheme by March 2006 to allow a six-month follow-up. Of 136 invitations, 86 (63%) participants replied and follow-up evaluations were completed.

71 participants reported exercising in some form while 15 reported not taking part in any form of exercise.

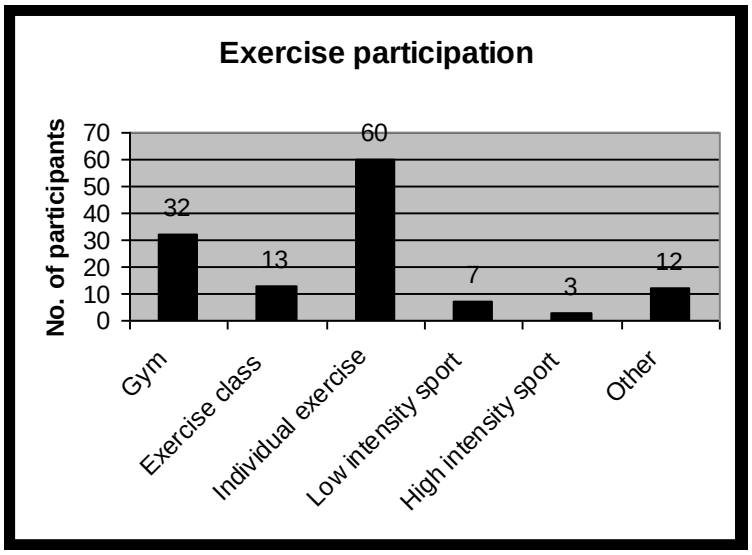
The 71 participants who were still exercising were asked what type of exercise they had been undertaking in the past month. Options included;

- attending a gym or an exercise class
- participating in individual exercise such as walking or swimming
- participating in low intensity sport such as golf or bowls
- participating in a high intensity sport such as badminton or squash.
- A category 'other' was also added. The majority of participants who stated an 'other' specified gardening or housework.

The number of people indicating that they were participating in each category is shown in figure 20. Please note that the total for all activities will exceed the number of participants as people may be participating in more than one activity.

It can be seen that almost all reported exercisers were participating in individual exercise such as walking or swimming at 6 months. Just under 50% of the exercisers were still attending the gym. The activities classed as 'other' by the participants were gardening and housework. However all participants who included the 'other' option also participated in a minimum of one other activity.

Figure 20



The main reasons quoted for continuation of exercise was ‘feeling better following exercise’ and ‘appreciating the benefits of exercise for weight management and health.’ Other reasons given were the enjoyment, the confidence gained and the meeting up with friends that had been made on the scheme.

The 14 participants reporting that they were no longer exercising were asked whether they had exercised at all during the 6 month period. Table 1 indicates how many people exercised for each time scale.

Table 1

Not at all	<1 month	1-3 months	3-5 months	Until recently
6	3	2	2	2

The main reasons given for stopping exercising were ill-health, time commitments and the lack of group support following the scheme. Other reasons given were lacking motivation and the confidence to exercise unsupervised.

When questioned about any changes that they would like to make to the scheme the main changes suggested were;

- regular ‘check ups’ from the scheme staff following the 12 weeks to check on progress
- maintenance classes
- more support and encouragement from scheme staff to help in the transition from group sessions to individual exercising
- A take home sheet with safety tips, common problems and exercise tips for guidance
- Taster sessions of other activities available in the centre e.g. badminton, yoga etc.

3.3.2 Sustainability of physical and psychological impact: 6 month follow-up.

Table 2 shows an overview of the results collected. This is followed by a more detailed breakdown of the results for each measured outcome.

Table 2

Key:
↑ indicates a significant improvement
⇔ indicates no significant difference
↓ indicates a significant deterioration

Measure	Change from pre to post scheme	Change from post scheme to 6 months	Change from pre scheme to 6 months
Health related QoL (EuroQol)	⇔	⇔	⇔
Self-rated health (EQ-VAS)	↑	⇔	⇔
Health related QoL- Physical component summary	↑	⇔	↑
Health related QoL- Mental component summary	↑	⇔	⇔
Anxiety	⇔	⇔	⇔
Depression	↑	⇔	⇔
Life Satisfaction	↑	⇔	⇔
Physical self-worth	↑	⇔	↑
Global self-worth	⇔	⇔	⇔
Habitual physical activity	↑	⇔	↑
Hip circumference	⇔	⇔	⇔
Waist circumference	↑	⇔	↑
Weight	⇔	⇔	⇔
Skin fold measurements	⇔	⇔	⇔
Resting heart rate	⇔	⇔	⇔
Resting blood pressure	⇔	⇔	⇔
Heart rate post exercise	⇔	⇔	⇔
Blood pressure post exercise	⇔	⇔	⇔
Fitness test duration	↑	⇔	↑

Psychological outcomes

No significant difference was found across the three time scales for;

- Health related quality of life using the EuroQoL
- Anxiety
- Global self-worth

Self-rated health

A significant improvement was found for self-rated health (EQ-VAS) from pre (67.56) to post (72.29) scheme. There was no significant difference between post scheme and 6 months (72.21) or pre scheme and 6 months. Although statistically this indicates that the improvements gained during the scheme were not sustained at 6 month follow-up this may be a result of low statistical power due to the limited participant numbers at the 6 month point. The trend of the data is for the self-rated health score at 6 months to remain improved.

Depression

A significant improvement was found for depression from pre (4.46) to post (3.84) scheme (indicated by a lower score). There was no significant difference between post scheme and 6 months (3.57) or pre scheme and 6 months scores. Although statistically this indicates that the improvements gained during the scheme were not sustained at 6 month follow-up this may be a result of low statistical power due to the limited participant numbers at the 6 month point. The trend of the data is for the depression at 6 months to be further improved.

Life Satisfaction

A significant improvement was found for life satisfaction from pre (23.15) to post (24.60) scheme. There was no significant difference between post scheme and 6 months (24.30) or pre scheme and 6 months scores. Although statistically this indicates that the improvements gained during the scheme were not sustained at 6 month follow-up this may be a result of low statistical power due to the limited participant numbers at the 6 month point. The trend of the data is for the life satisfaction score at 6 months to remain improved.

Physical self-worth

A significant improvement was found for physical self-worth from pre (12.76) to post (14.21) scheme. No significant difference was found between post scheme and 6 month follow-up (14.70) scores. A significant improvement was found between pre scheme and 6 month follow-up scores indicating that the improvement in physical self-worth achieved during the scheme was sustained at 6 month follow-up.

Habitual Physical activity

A significant increase in habitual physical activity was found from pre (5.49) to post (6.18) scheme. No significant difference was found from post scheme to 6 month follow-up (6.05). However a significant increase was found between pre scheme scores and 6 month follow-up scores indicating than the increased habitual physical activity was maintained at follow-up.

Health related quality of life using the SF-36V2
A significant increase in the physical component summary score of the SF-36V2 was found from pre (39.20) to post (43.42) scheme. No significant difference was found from post scheme to 6 month follow-up (44.68). However a significant increase was found between pre scheme scores and 6 month follow-up scores indicating than the increased physical component summary score was maintained at follow-up.

There was also a significant improvement in the mental component summary score of the SF-36V2 from pre (44.80) to post scheme (52.53). There was however no significant difference from post scheme to 6 month follow-up (47.22) or between pre-scheme and 6 month follow-up. Although statistically this indicates that the improvements gained during the scheme were not sustained at 6 month follow-up this may be a result of low statistical power due to the limited participant numbers at the 6 month point. The trend of the data is for the self-rated health score at 6 months to remain improved.

Physiological Measurements

No significant difference between the three time scales was found for;

- Hip circumference
- Weight
- Skin fold measurements
- Resting heart rate
- Resting systolic blood pressure
- Resting diastolic blood pressure
- Heart rate post exercise
- Systolic blood pressure post exercise
- Diastolic blood pressure post exercise

Waist circumference
A significant improvement was found for waist circumference from pre (99.14cm) to post (98.65cm) scheme. No significant difference was found between post scheme and 6 month follow-up (97.10cm) scores. A significant improvement was found between pre scheme and 6 month follow-up scores indicating that the improvement in waist circumference achieved during the scheme was sustained at 6 month follow-up.

Cardiovascular fitness as indicated by treadmill test duration.
A significant difference was found between treadmill test duration pre scheme (7.20min) and post scheme (9.50min). No significant difference was found between post scheme and 6 month follow-up (9.17min). A significant difference was found between pre scheme and 6 month follow-up indicating that cardiovascular fitness had been sustained at 6 month follow-up.

Figure 21 illustrates the number of participants finishing the treadmill test at the end of each modified Bruce stage. It can be seen that substantially fewer participants finish before the end of stage 0 (<3mins) post scheme and at 6

month follow-up than pre. Substantially fewer people finish following stages <0 and 0 (3 min) post scheme and at 6 month follow-up than pre scheme while substantially more finish having completed stage 1 (9 min) and 2 (12 min) at post scheme and 6 month follow-up than at pre scheme.

Figure 21

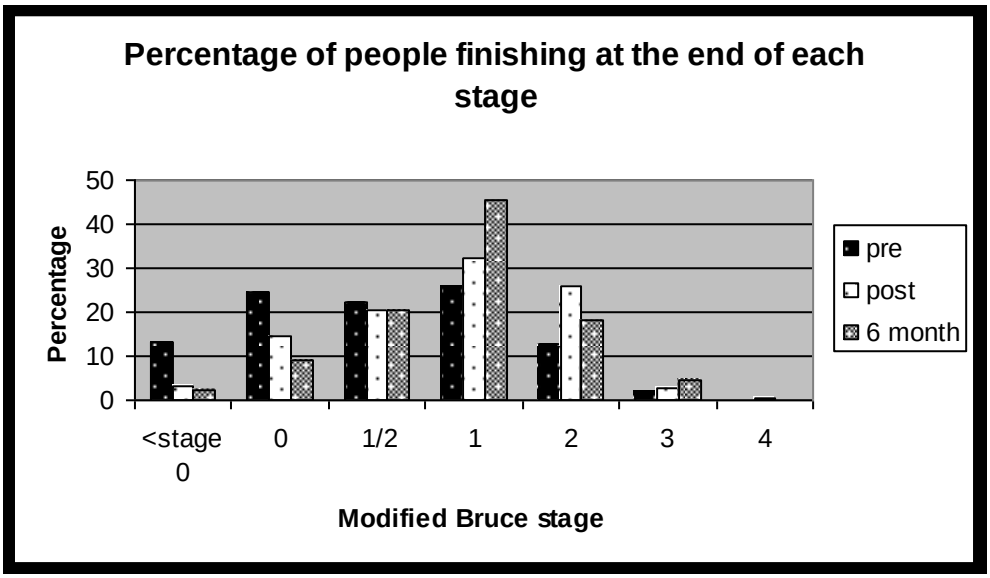
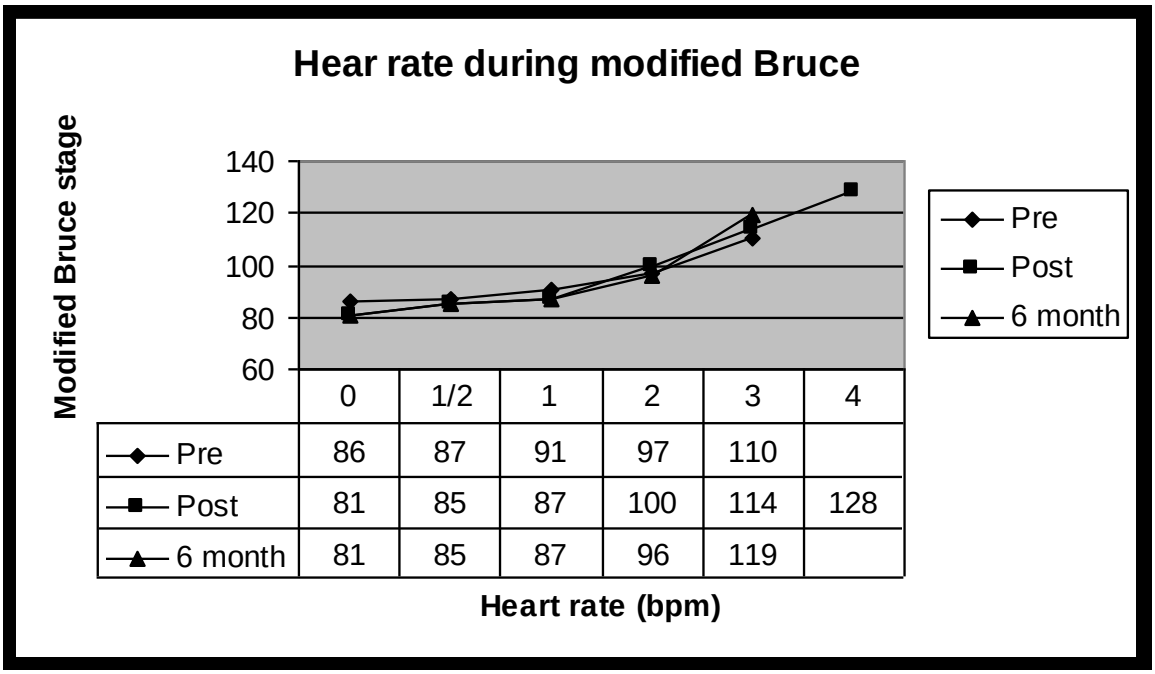


Figure 22 shows participants' heart rates at the end of each modified Bruce treadmill test stage for the three time points. It can be seen that heart rate at 6 months is fairly comparable with post scheme readings until stage 2, at which point heart rate is lower than at post and pre scheme. However at stage 3, heart rate at 6 months is higher than at pre and post scheme.

Figure 22



	0	1/2	1	2	3	4
Pre	86	87	91	97	110	
Post	81	85	87	100	114	128
6 month	81	85	87	96	119	

➢ 4. Negative Effects

No resuscitations or deaths occurred during the duration of the research as a result of the exercise classes. A small number of participants were referred to hospital by the cardiac rehabilitation nurse having arrived at classes unwell or exhibiting cardiac symptoms. However these participants had not been permitted to participate in the class on that occasion. One participant was hospitalised following an exercise class due to feeling dizzy and a drop in blood pressure. However the participant was discharged the same day.

➢ 5. Evaluation of processes

Partnership working has yielded benefits of cost-saving, efficiency and knowledge through the sharing of office space, equipment and staff. Partnership working has provided challenges in reconciling differing financial and personnel practices and processing. Nevertheless, the management structure has proved effective since the Scheme has fulfilled all the conditions of the grant award, has run to budget, produced all required reports on time, and most importantly has recruited and provided benefit to a large number of participants.

Promotion of the Scheme included personal visits to GP surgeries, Ceredigion Specialist Nurses Group, Ceredigion Physiotherapists, Ceredigion and mid-Wales NHS Trust, and leisure centre managers. A health promotion bus tour around local towns in 2004, along with a number of articles in the local press all helped to raise awareness of the Scheme. Referrals from hospitals were good but there was variable engagement of health centres.

The Scheme ran in four leisure centres spread across the county. No budget had been allocated to cover taxi or bus fares. However in the event a handful of participants did require assistance and therefore money was released from the budget. The low demand for this service indicates that the classes were being run in appropriate locations. It is worth noting (see figure 2) that all four leisure centres were well used. A Scheme that had been based, say, just in Aberystwyth may have excluded a large number of people in need.

➢ 6. Participant evaluation

On exit of the scheme all participants were sent an exit evaluation form to complete and return anonymously. This questioned participants about the leisure centre facilities and the general running of the scheme. 60% of participants returned a form. The following information relates to returned forms only.

Leisure Centres

- 78% of participants reported that the changing facilities were 'always' clean and tidy with 3% answering 'sometimes', 1% of people answering 'rarely' regarding Sir Geraint Evans Leisure Centre, Aberaeron and 18% not responding to this question.
- 96% reported the gym facilities were 'always' clean and tidy with 4% reporting 'sometimes'.
- Parking at the centres was reported as 'always' being adequate by 71% of participants, while 20% reported 'sometimes' adequate and 9% did not respond to this question.
- Leisure centre staff were reported as 'always' being helpful by 98% of participants. 2% did not respond to this question.
- The gym temperature was reported as being just right by 92% of participants with the balance replying too hot or too cold.

Scheme staff

- 98% of participants reported being made to feel comfortable during their consultation with the cardiac rehabilitation nurse 'at all times', were given the information that they needed 'at all times' and felt able to ask questions 'at all times.' 2% did not answer these questions.

Scheme delivery

- 88% of participants reported 'definitely' thinking that the classes were of benefit to their health, 11% reporting 'somewhat' and 1% reporting 'not really.'
- 83% of participants reported 'definitely' progressing in fitness during the scheme while 14% answered 'somewhat' and 1% 'not really'. 2% did not respond
- 95% of participants thought that the classes were 'definitely' well organised, 5% thought that they were 'somewhat' organised.
- 92% of participants thought that the classes were 'definitely' enjoyable, 6% found them 'somewhat' enjoyable while 2% reported 'not really' finding the classes enjoyable.
- Following the scheme 81% of participants 'definitely' felt confident about exercising independently, 6% felt 'somewhat' confident and 2% 'not really' feeling confident (remainder not responding).
- On asking whether participants had a preference for gym or circuit classes, 50% had no preference, 27% had a preference for the gym while 15% had a preference for circuit classes. 8% did not respond to this question.

Supplementary activities

In addition to the twice weekly classes, the scheme also offered a number of health talks on various topics (such as medication, blood pressure, and exercise principles), relaxation sessions and walks.

- All talks were classed as useful by the vast majority of participants who had attended.
- Nearly all participants reported feeling relaxed following the relaxation session and reported feeling able to use the techniques independently.
- Only 16% of participants reported attending a walk, with 55% reporting 'no walk being available' to them during their time on the scheme. It should be noted that walks were only provided during the summer months to increase the likelihood of good weather. Of those participants that attended a walk all reported it as being enjoyable.

Overall therefore the Scheme received very strong support from the participants. The environment provided by the sports centres was excellent, staff were considered helpful and supportive, and participants felt the classes were well-organised, enjoyable and led to improved health and fitness. Further, more detailed analysis of psychological factors is included in appendix 3. This analysis shows that the structure of the Scheme and the approach of the exercise leaders helped participants improve in feelings of competence, autonomy and relatedness. These improvements increase subject motivation and lead to improved continuation of exercise once a person leaves the Scheme.

➢ 7. Cost Benefit

Very few robust economic analyses are available on the cost-benefit of cardiac rehabilitation exercise schemes. It is argued that the benefits of a scheme are shown in life years gained, the quality of life, quality adjusted life years (QALY) gained, increased employment, and a reduction in on-going care and treatment costs. Scheme costs might vary from as low as £50 per patient where a scheme is limited to the provision of an advice booklet to over £1000 per patient where a scheme involves a lengthy programme of exercise led by a professional.

Work from Ireland (Swales 2000) and Scotland (Gillespie et al. 2003) has recently been supplemented by NICE (2006) which provides a contemporary review of the economic cost-benefit evidence. All three reports identify that exercise has a positive benefit in relation to cost. NICE (2006) quote cardiac rehabilitation at £6400 per life year gained and £2700 per QALY gained. This cost may be compared with the rounded standard criterion that for a medical intervention to be judged cost-effective it should have a cost of less than £20,000 per QALY gained.

Cost

501 participants were offered a place on the scheme within the timeframe of this report of whom 71% (356) undertook classes within the Ceredigion Scheme giving a per person treated cost of £802. This is typical of a scheme involving regular exercise supervised by specialists over an extended period. If allowance is made for the start-up costs of this new scheme, the continuing running costs are £722 per new participant.

Benefit

We do not have a direct measurement of economic benefit since this would require extensive longitudinal monitoring of medication, morbidity and mortality. We must therefore attempt an approximate estimate of benefit.

i) Added years of life

We note no hospitalisations, resuscitations or deaths occurred during the duration of the research as a result of the exercise classes. It is impossible to estimate the added life years without monitoring of mortality over many years.

ii) Direct treatment and care costs

We have no direct data on whether treatment or care costs declined.

The improved physical capability would likely reduce care costs but we have no information on these. Taking a conservative approach we have not therefore allocated a financial benefit.

iii) Quality of life

Quantifying the improved quality of life will include the direct improvement during the 12 weeks of the exercise programme, plus the any sustained benefit afterwards

During the 12 weeks of the exercise classes there were significant improvements in psychological well-being and functional physical capability. With allowance for those participants who did not complete the scheme (31%) we might estimate that the Scheme, on an intent to treat basis, has added quality of life to 356 (people) * 0.69 (completion rate) * 12 (weeks) or 57 person-years in total.

The six-month post-scheme data show continued increased activity and enhanced health and well-being. Of 136 people contacted 86 replied and 71 were still active. Since it is more likely that active people will choose to respond, we must assume a lower proportion of the non-responders were still active. Conservatively we have assumed the proportion of active non-responders to be half that of the responders. Since 82% (71/86) of the responders were still active, we are assuming just 41% of the non-responders are still active. There were 50 non-responders so we are assuming 21 of these are active and 29 are not active. This gives an overall still-active rate of (71+ 21) /136 = 68%. This applies to the first six months after finishing in the scheme. Over a longer time period more participants will stop exercising. Most drop-out occurs in the first months after finishing a project, but if conservatively we assume the drop-off continues at the same rate then we would expect 68% of the continuing exercisers to still be active six months later (i.e. 46% of the starting number are still going after 12 months), a further 68% of continuing exercise to still be active six months further on (i.e. 31% of the starting number still going after 18 months)and so on.

It could therefore be estimated that, on average, the sustained impact of the Scheme once participants leave the classes would be

> For each six month block: Total participants multiplied by the proportion of participants still active

We have then totalled these over two years of six month blocks. We have taken two years as a reasonable, but conservative, time frame over which to be able to claim continued impact once the scheme had finished.

> First six month block
>
> (356 x 68%) x 0.5 years = 121 person-years of benefit
>
> Second six month block
>
> (356 x 46%) x 0.5 years = 82 person-years of benefit
>
> Third six month block
>
> (356 x 31%) x 0.5 years = 55 person-years of benefit
>
> Fourth six month block
>
> (356 x 21%) x 0.5 years = 37 person-years of benefit
>
> Total post-scheme sustained benefit = 295 person-years

In total therefore we can estimate that Scheme has improved qualify of life (mental and physical) for 57 person-years during the period of the exercise classes plus 295 person-years subsequently, a total of 352 person-years.

This tentative estimate for the Ceredigion Scheme averages £285,535/352 or £811 per added quality of life year.

Quality adjusted life years

The above analysis expresses the data in simple terms of years of enhanced quality of life. But this analysis does not account for the degree of enhanced quality. The concept of quality adjusted life years (QALY) rates the quality of life on a scale from 1 (perfect health) to 0 (death). Estimating the rating for any individual person is a matter of judgement. The present evaluation does allow some objectivity in this judgement by examining the data for the various health measures. In particular, the EuroQoL is a recognised instrument and has been used in other research as a way of considering whether a treatment has changed QALY. Fig 9 shows the treatment produced a 10% improvement in EQ-5D overall scores. These data are supported by the similar magnitude of change in many of the other measures taken. And the sustained impact of the scheme is demonstrated by the longitudinal data.

We can therefore tentatively consider that each added quality of life year improved that quality by 10%. The overall impact of the scheme, expressed in quality adjusted life years is therefore 352 x 10% = 35.2 QALY

In financial terms this equals £285,535/35.2 or £8112 per QALY.

This figure may be compared, with caution, to QALY estimates for other medical treatments. Clearly, even allowing for an element of estimation, the cost is well below the criterion value of £20,000 per QALY.

➢ 8. Conclusion

In summary, the scheme:

- Provided Phase IV provision where none existed in Ceredigion
- Demonstrated need by recruiting 577 participants in 2½ years
- Identified the importance of a local community-base and an emphasis on patient confidence and independence in achieving high participation and low attrition
- Demonstrated a sustained impact at 6-month follow-up once participants had left the scheme
- Demonstrated significant improvements in physical and psychological health at a cost per patient of £802 leading to an estimated improvement in quality adjusted life years at a cost of £8112.

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➢ Appendix 1

Borg rate of perceived exertion scale

6

7 Very, very light

8

9 Very light

10

11 Fairly light

12

13 Somewhat Hard

14

15 Hard

16

17 Very Hard

18

19 Very, Very Hard

20

➢ Appendix 2

Modified Bruce Protocol

Stage	Time	KmPH	Gradient %
0	3	2.74	0
½	6	2.74	5
1	9	2.74	10
2	12	4.02	12
3	15	5.47	14
4	18	6.76	16
5	20	8.05	18

➢ Appendix 3

Additional research

Further psychological data were gathered as part of an additional project. This research looked more in detail at the motivation of participants to exercise and how some basic psychological needs were met by the scheme. The self-determination theory (Deci and Ryan, 1985) states that there are five different types of motivation:

- Amotivation, which is a total lack of motivation to carry out a behaviour;
- External motivation, which is the motivation to do something for an external reward or as a result of pressure from an external source (e.g. family or GP);
- Introjected motivation, which is the motivation through pressure put on the individual by themselves and often results in feelings of guilt if the behaviour isn't carried out;
- Identified motivation, which is the motivation to do something because of the value placed upon that behaviour *(e.g.* valuing the health benefits of exercise);
- Intrinsic motivation, which is the motivation to carry out a behaviour for the sheer pleasure of taking part.

Although being externally motivated encourages a person to take part in a behaviour, this is often a temporary effect as once this external pressure is removed the motivation often decreases. However the more identified or intrinsically motivated a person is for a behaviour the more likely they are to carry out that behaviour long-term. It follows therefore that a scheme such as this should aim to encourage participants to develop high levels of intrinsic or identified motivation to encourage long term exercise participation and discourage external motivation or amotivation.

The Cognitive Evaluation theory (Deci and Ryan, 1985) states that in order to encourage intrinsic motivation three fundamental psychological needs must be satisfied. These are the needs for autonomy, competence and relatedness. The need for autonomy satisfaction relates to the need to feel volitional in the behaviour and not to feel controlled. The need for competence satisfaction relates to the need to feel good at the behaviour while the need for relatedness is the need to feel supported and accepted within the particular setting. The more satisfied within these three needs an individual is the more likely they are to be self-determined in their motivation (i.e. intrinsically motivated).

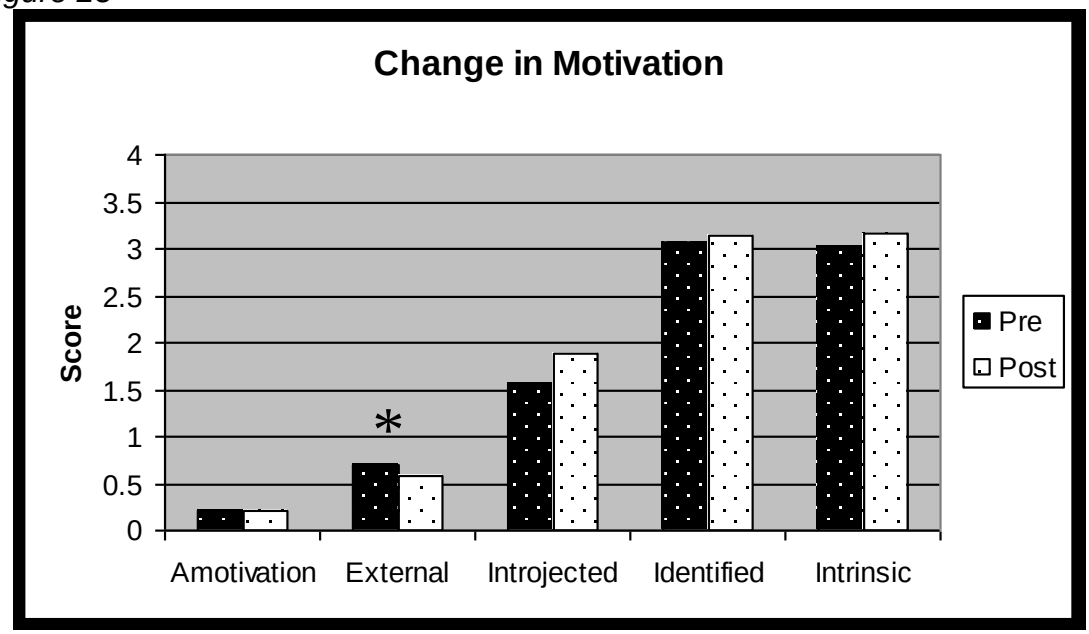
These needs can be fostered in a number of ways, for example:

- Providing people with information so that they can make an informed choice to take part in the scheme to encourage autonomy satisfaction;
- To provide participants with positive feedback about their own personal improvements rather than developing a competitive group setting to encourage the satisfaction of competence needs;
- To encourage socialisation within the group to encourage the satisfaction of relatedness needs.

Procedure
Following their second gym session and on exiting the scheme, participants were asked to complete the BREQ-2 questionnaire measuring exercise motivation and the Need Satisfaction Scale.

Results
Figure 23 indicates the motivation scores from pre to post scheme (score range 0-4). It can be seen that on entry to the scheme Identified and Intrinsic motivation scores were already high and remained high until the end of the 12 week programme. Wilcoxon signed-rank statistics indicated that from pre to post scheme there was a significant decrease in external motivation scores.

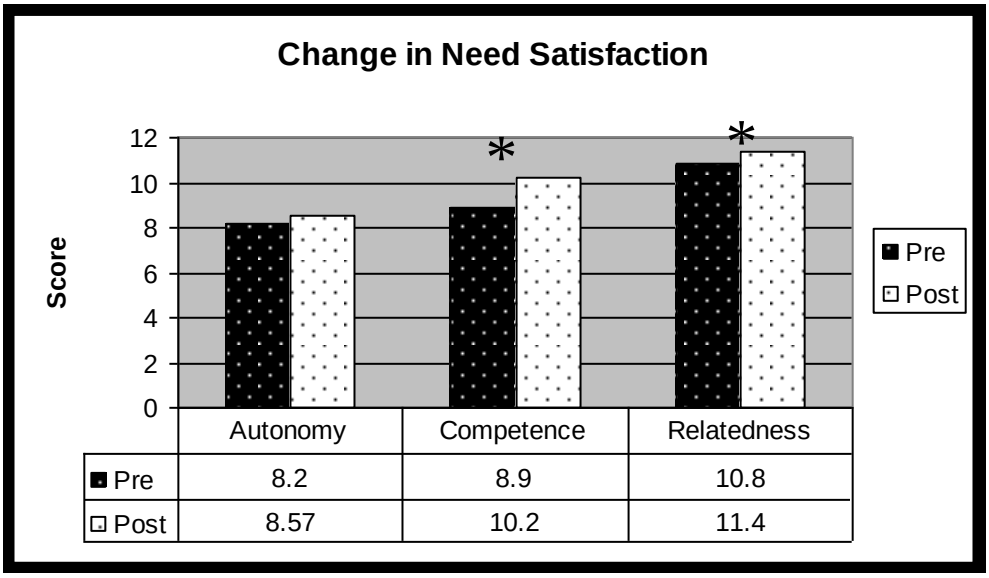
Figure 23



* indicates significant difference

Need satisfaction scores for all three psychological needs were fairly high on entering the scheme (scores range from 0-12) indicating that the scheme fostered high need satisfaction from very early on in the scheme. Despite this, a significant increase in competence and relatedness satisfaction was still found from pre to post scheme indicating that the environment fostered by the exercise leaders encouraged the satisfaction of these needs throughout the 12 weeks (see figure 24). This could go some way to explaining the above average completion rate of the scheme.

Figure 24



* indicates significant difference

Cardiac Rehabilitation Staff

Amanda Jones	Medical Directorate Manager
Denise Lewis	Cardiac Rehabilitation Coordinator
Gwenllian Parry	Community Cardiac Rehabilitation Specialist Nurse
Justyn Robbins	Cardiac Rehabilitation Fitness Instructor
Diane Jones	Administrative Assistant
Sarah Arden	Cardiac Rehabilitation Fitness Instructor (Year One)

University of Wales Aberystwyth

Professor Jo Doust	Formerly Head of Department of Sport and Exercise Science University of Wales Aberystwyth, now Head of Department University of Brighton.
Rachel Rahman	Research Assistant
Cecilie Thøgersen-Ntoumani	Advisory Psychologist

For more information regarding this report please contact;

Professor Jo Doust j.h.doust@brighton.ac.uk
or
Rachel Rahman rra03@aber.ac.uk